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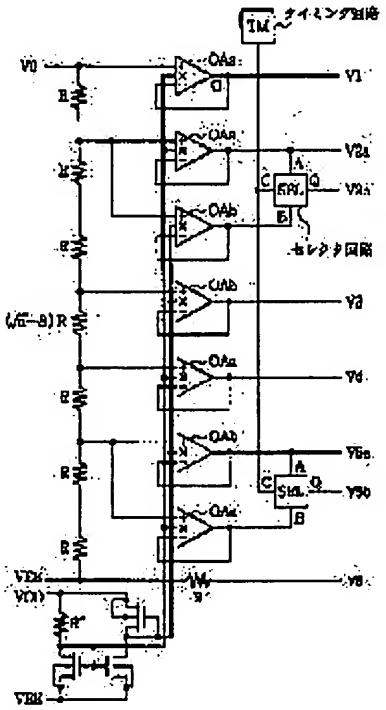
(54) LIQUID CRYSTAL DRIVING POWER SOURCE CIRCUIT

(57)Abstract:

PROBLEM TO BE SOLVED: To prevent distortion in a waveform and deterioration in picture quality by voltage dividing between plural source potential and switching an operational amplifier circuit receiving its output voltage and charge driving a liquid crystal display element with the operational amplifier circuit receiving the output voltage and discharge driving the liquid crystal display element at the prescribed timing.

SOLUTION: Resistors R potential divide between a plus side power source V0 and a minus side power source VEE, and operational amplifiers OAa, OAb impedance convert the divided voltage to supply liquid crystal element driving power sources (V1, V2a, V2b, V3, V4, Va, V5b). A selector circuit SEL controlled by a timing generation circuit TM switches the operational amplifiers OAa, OAb at the switch timing considering directions of charge/discharge for liquid crystal load capacity related to the voltages V2b, V5b to output the voltages V2b, V5b. Thus, the distortion in the waveform and the deterioration in the picture quality due to the drive power shortage of the power source are prevented even in a display device, etc., with large capacity of liquid crystal material.



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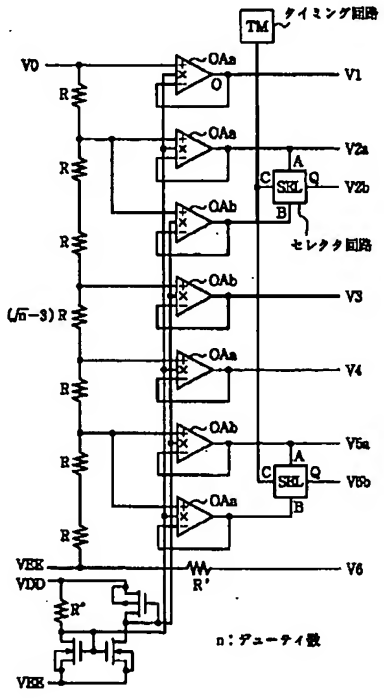
(54)【発明の名称】　液晶駆動用電源回路

(57)【要約】

【課題】低消費電力でかつ波形の歪や液晶画質の悪化を防止するための液晶駆動用電源電圧を供給することを目的とする。

【解決手段】液晶表示素子を駆動するためのオペアンプ回路を充電用・放電用のＺ回路を別々に有し、上記回路を充放電のタイミングにより切り換えるためのスイッチ回路およびそのタイミングを発生させるためのタイミング回路を有する。これにより各オペアンプ回路の低消費電力化をはかる。



【特許請求の範囲】
【請求項１】　第１の電源電位と第２の電源電位との間を分圧する複数の抵抗を有する抵抗分圧回路と、この抵抗分圧回路の出力電圧を入力に受け液晶表示素子を充電駆動する第１のオペアンプ回路と、前記抵抗分圧回路の出力電圧を入力に受け前記液晶表示素子を放電駆動する第２のオペアンプ回路と、前記第１のオペアンプ回路と前記第２のオペアンプ回路を所定のタイミングで切り換える第１のスイッチ回路と、この第１のスイッチ回路を制御するタイミング回路とを有することを特徴とする液晶駆動用電源回路。
【請求項２】　前記抵抗分圧回路の出力電圧を受け前記タイミング回路により前記抵抗分圧回路の供給レベル電圧を切り換える第２のスイッチ回路を有することを特徴とする請求項１記載の液晶駆動用電源回路。
【請求項３】　前記第１のスイッチ回路と前記第２のスイッチ回路とが前記タイミング回路により同期して動作する請求項２記載の液晶駆動用電源回路
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は液晶表示装置に係り、特に時分割数（デューティ）が大きい中型又は大型のドットマトリックスタイプの液晶表示素子に好適な液晶駆動用電源回路に関する。
【０００２】
【従来の技術】図６を参照すると、従来の液晶駆動回路は、この液晶駆動回路における液晶電圧をプラス側電源（例えば＋１０Ｖ）とマイナス側電源（例えば０Ｖ）との電圧差を内部抵抗により分圧し、さらにボルテージフォロア型オペアンプによりインピーダンス変換したものを直接液晶駆動電圧とする。
【０００３】このような従来の液晶駆動回路は、例えば特開平５－２７３９３２号公報に開示されている。この従来の回路構成では中型又は大型の液晶表示素子を駆動する場合、各オペアンプの駆動能力を上げて用いる。
【０００４】
【発明が解決しようとする課題】しかしながら従来の回路構成では以下に示す問題点がある。
【０００５】（１）液晶の表示素子数が大きくなるとそれだけ電源の駆動能力が必要になるため、各オペアンプの駆動能力を上げる必要があり、消費電流が大きくなってしまう。
【０００６】（２）液晶素子は一般にはコモン電極とセグメント電極間に電圧を印加することにより表示することを可能にするが、セグメント数つまり表示行数が多くなれば、コモン電極は共通であるため、各コモンにかかる負荷容量（液晶素子は容量負荷であるため）が大きくなるが図６に示す様に例えばデューティ数がｎの場合、ｎ番目のコモンに関しては液晶負荷からの充放電が１番目から（ｎ－１）番目までのコモンに比べ放電電荷が大きく、その結果ｎ番目コモンの駆動能力を考えると充電放電の両方の能力を持ったオペアンプを使用する必要があり消費電力を極力小さくすることができないという問題がある。
【０００７】
【課題を解決するための手段】本発明の液晶駆動用電源回路は、第１の電源電位と第２の電源電位との間を分圧する複数の抵抗を有する抵抗分圧回路と、この抵抗分圧回路の出力電圧を入力に受け液晶表示素子を充電駆動する第１のオペアンプ回路と、前記抵抗分圧回路の出力電圧を入力に受け前記液晶表示素子を放電駆動する第２のオペアンプ回路と、前記第１のオペアンプ回路と前記第２のオペアンプ回路を所定のタイミングで切り換える第１のスイッチ回路と、この第１のスイッチ回路を制御するタイミング回路とを有する構成である。
【０００８】また、前記抵抗分圧回路の出力電圧を受け前記タイミング回路により前記抵抗分圧回路の供給レベル電圧を切り換える第２のスイッチ回路を有する構成とすることもできる。
【０００９】さらにまた、本発明の液晶駆動用電源回路の前記第１のスイッチ回路と前記第２のスイッチ回路とが前記タイミング回路により同期して動作する構成とすることもできる。
【００１０】
【発明の実施の形態】本発明の第１の実施の形態を図を参照して説明する。
【００１１】図１を参照すると本実施の形態の液晶駆動用電源回路は、プラス側電源Ｖ０とマイナス側電源ＶＥＥの両電源間を電位分割する抵抗Ｒと、それぞれ分割した電圧をインピーダンス変換し、液晶素子駆動用電源（Ｖ１，Ｖ２ａ，Ｖ２ｂ，Ｖ３，Ｖ４，Ｖａ，Ｖ５ｂ）の７レベルを供給するオペアンプ（ＯＡａ，ＯＡｂ）を備える。さらに、電圧Ｖ２ｂおよびＶ５ｂについては液晶負荷容量に対する充放電の向きを考慮した図２に示す様な切換えタイミングにより（Ａ，Ｂに示すコモンｎ番目の波形エッジ）アンプＯＡａ，ＯＡｂを切換えて電圧Ｖ２ｂ，Ｖ５ｂをそれぞれ出力するセレクタ回路ＳＥＬおよびセレクタ回路ＳＥＬを制御するタイミング発生回路ＴＭを備える。各基準電圧（Ｖ１～Ｖ６）とコモンとの対応は、デューティ数ｎの液晶装置を例にすると、コモン１番目～（ｎ－１）番目は電圧Ｖ１，Ｖ２ａ，Ｖ５ａ，Ｖ６の各レベルを選択し、コモンのｎ番目は電圧Ｖ１，Ｖ２ｂ，Ｖ５ｂ，Ｖ６レベルを選択することになる。
【００１２】次に、回路上の抵抗Ｒの設定について説明すると、まず抵抗Ｒは基本的に電源間Ｖ０～ＶＥＥを単に分圧するだけであり、電流値を小さくするために大きな定数のものを選ぶ。また抵抗Ｒ′はオペアンプ（ＯＡａ，又はＯＡｂ）のインピーダンスとほぼ等しい定数を選び全体のバランスを均等にする。

【００１３】抵抗R″は各オペアンプでの低電流回路に流す電流値を決める抵抗であり、全体の消費電流を小さくするために数百ＫΩ程度の大きなものを選択する。

【００１４】また図２に示すパルス幅ｔｓ及びｔｈについてはセグメント、コモン出力の応答時間を考慮して、数十μｓ程度で設定することによりタイミングのずれによる表示への影響がない様に十分時間をとる。

【００１５】次に、本発明の第２の実施の形態を図４および図５を参照して説明する。

【００１６】図４を参照すると、この実施の形態は、第１の電源電位Ｖ０をレベル電圧Ｖ１に調整する抵抗R′と抵抗分圧回路の出力電圧のうち２個の出力電圧を切り換えるセレクタ回路ＳＥＬ２をさらに備える以外は第１の実施の形態と同一構成であり、同一の構成要素には同一参照符号を付して図示してある。

【００１７】この実施の形態のタイミング回路ＴＭは図５に示すようにセレクタ回路ＳＥＬ１を駆動する出力０１とセレクタ回路ＳＥＬ２を駆動する出力０２を同期して出力しこの実施の形態の液晶表示駆動電圧（Ｖ１～Ｖ６）はそれぞれセレクタ回路ＳＥＬ１，ＳＥＬ２の切り換えにより図５に示す波形を出力する。

【００１８】本発明の第２の実施の形態は、電圧Ｖ０を調整する場合の回路構成であり、プラス側電源電位Ｖ０を高圧系電源ＶＤＤとして、内部又は外部より供給する場合、オペアンプ回路ＯＡａを用いてインピーダンス変換する必要がない。したがって出力レベルＶ１のオペアンプ回路ＯＡａは不要となる。また出力レベルＶ２ａを入力するオペアンプＯＡａとレベルＶ４を入力するオペアンプのＯＡａとは同一時間内では同時に選択されないため共用することが可能であり、出力レベルＶ５を入力するオペアンプＯＡｂと出力レベルを入力するオペアンプＯＡｂもまた共用可能となる。従ってオペアンプ回路を第１の実施の形態より３個削除して同一の効果を得ることが可能となり、さらに低消費電力化をはかることができる。

【００１９】

【発明の効果】以上説明した様に本発明によれば、液晶材の容量が大きい表示装置や、大型パネルの液晶表示素子においても、電源の駆動能力不足による波形の歪や画質の悪化を防止することができかつ電源回路を有する液晶駆動用の半導体素子の消費電力を小さくする効果がある。

【図面の簡単な説明】

【図１】本発明の液晶駆動用電源回路の第１の実施の形態の回路図である。

【図２】図１に示したタイミング回路の出力タイミング波形である。

【図３】図１に示したオペアンプ回路の回路図である。

【図４】本発明の第２の実施の形態の回路図である。

【図５】図４に示したタイミング回路の出力波形である。

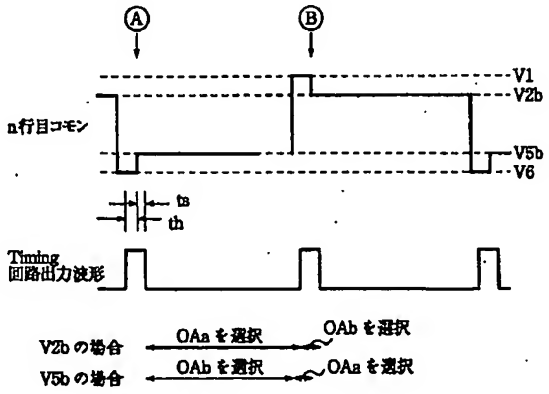
【図６】従来の液晶駆動用電源回路の回路図である。

【図７】図６の電圧Ｖ１～Ｖ６と液晶駆動時のコモンおよびセグメント波形を示すタイミングチャートである。

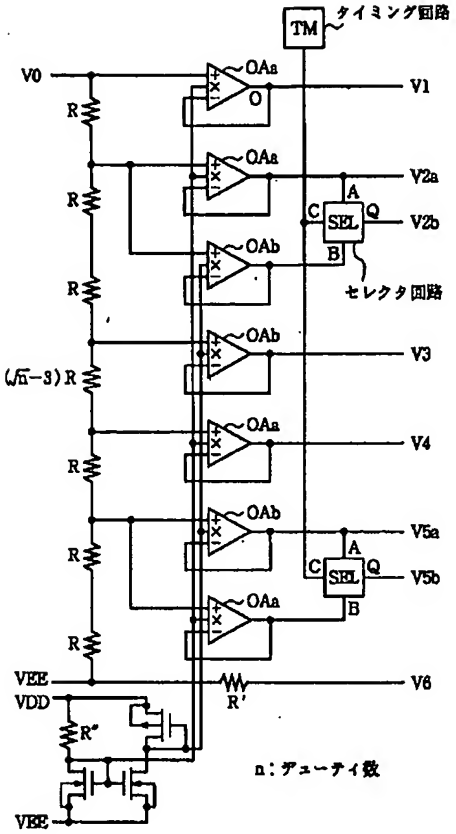
【符号の説明】

Ｖ１～Ｖ６　液晶駆動電圧
Ｖ０　プラス電源
ＶＥＥ　マイナス電源
ＯＡａ，ｂ　オペアンプ
Ｒ　ブリーダ抵抗
Ｒ′　補助抵抗
Ｒ″　バイアス抵抗
ＴＭ　タイミング発生回路
ＳＥＬ　セレクタ回路
ＶＤＤ　高圧系電源

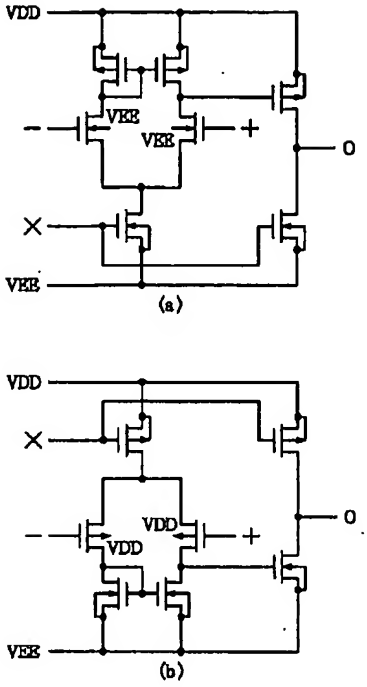
【図２】



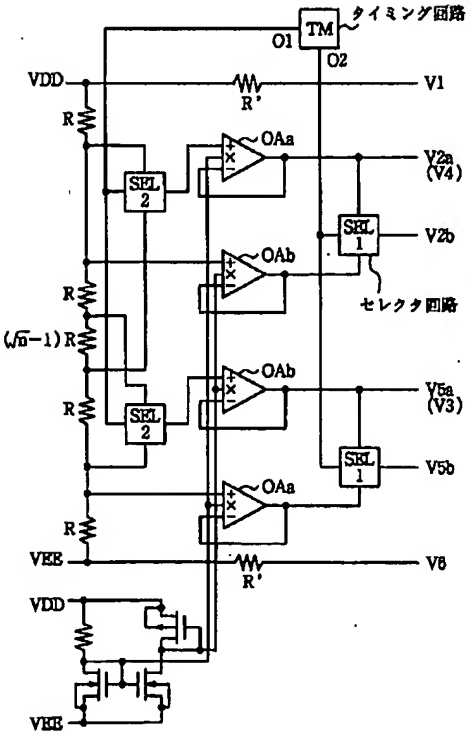
【図1】


TM
タイミング回路
V0
OAa
OAb
V1
V2a
V2b
V3
V4
V5a
V5b
V6
R
(√n−3)R
SEL
A
B
C
Q
セレクタ回路
VEE
VDD
R'
R"
n：デューティ数

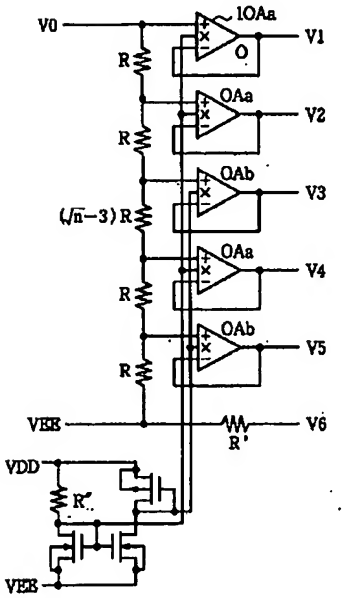
【図3】


VDD
VEE
O
(a)
(b)

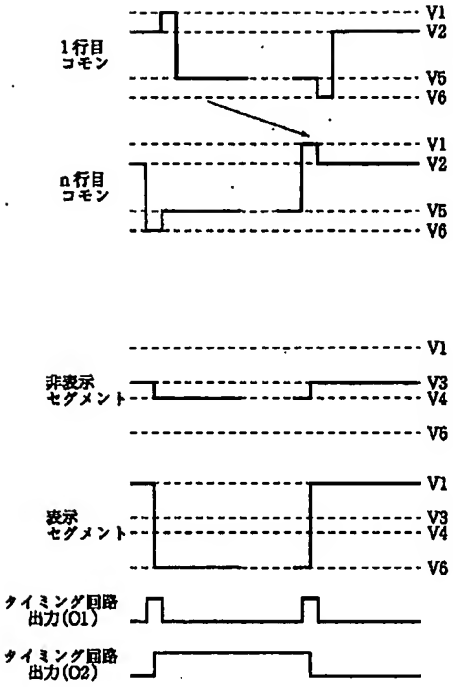
【図4】


TM
タイミング回路
O1
O2
VDD
VEE
R
R'
OAa
OAb
SEL
1
2
V1
V2a
(V4)
V2b
V5a
(V3)
V5b
V6
セレクタ回路
(√n−1)R

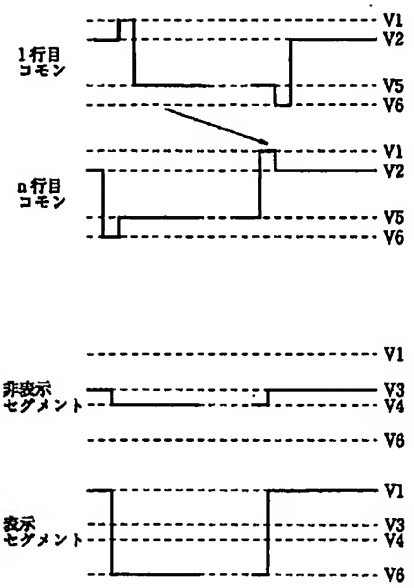
【図6】


V0
1OAa
OAa
OAb
V1
V2
V3
V4
V5
V6
R
(√n−3)R
VEE
VDD
R'
R"

【図5】


1行目
コモン
n行目
コモン
非表示
セグメント
表示
セグメント
タイミング回路
出力(O1)
タイミング回路
出力(O2)
V1
V2
V3
V4
V5
V6

【図7】


1行目
コモン
n行目
コモン
非表示
セグメント
表示
セグメント
V1
V2
V3
V4
V5
V6

CLAIMS

[Claim(s)]

[Claim 1] The resistance partial pressure circuit which has two or more resistance which pressures partially between the 1st power-source potential and the 2nd power-source potential, The 1st operational amplifier circuit which receives the output voltage of this resistance partial pressure circuit in an input, and carries out charge actuation of the liquid crystal display component, The 2nd operational amplifier circuit which receives the output voltage of said resistance partial pressure circuit in an input, and carries out discharge actuation of said liquid crystal display component, The power circuit for liquid crystal actuation characterized by having said 1st operational amplifier circuit, the 1st switching circuit which switches said 2nd operational amplifier circuit to predetermined timing, and the timing circuit which controls this 1st switching circuit.

[Claim 2] The power circuit for liquid crystal actuation according to claim 1 characterized by having the 2nd switching circuit which receives the output voltage of said resistance partial pressure circuit, and switches the supply level electrical potential difference of said resistance partial pressure circuit by said timing circuit.

[Claim 3] The power circuit for liquid crystal actuation according to claim 2 which said the 1st switching circuit and said 2nd switching circuit synchronize by said timing circuit, and operates

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to a liquid crystal display, especially the number of time sharing (duty) is related with the suitable power circuit for liquid crystal actuation for a large medium size or a liquid crystal display component large-sized dot-matrix type.

[0002]

[Description of the Prior Art] If drawing 6 is referred to, the conventional liquid crystal actuation circuit will pressure partially the electrical-potential-difference difference of a plus side power source (for example, +10V) and a minus side power source (for example, 0V) for the liquid crystal electrical potential difference in this liquid crystal actuation circuit with internal resistance, and will make what carried out impedance conversion with the voltage follower mold operational amplifier further direct liquid crystal driver voltage.

[0003] Such a conventional liquid crystal actuation circuit is indicated by JP,5-273932,A. In this conventional circuitry, when driving a medium size or a large-sized liquid crystal display component, the actuation capacity of each operational

amplifier is improved and used.

[0004]

[Problem(s) to be Solved by the Invention] However, there is a trouble shown below in conventional circuitry.

[0005] (1) Since the actuation capacity of a power source is so much needed when the number of display devices of liquid crystal becomes large, it will be necessary to improve the actuation capacity of each operational amplifier, and the consumed electric current will become large.

[0006] (2) Although a liquid crystal device generally makes possible what is displayed by impressing an electrical potential difference to a common electrode and segment inter-electrode If the number of several segment ball display lines increases, since the common electrode is common, When the number of duty is n although each common ** or the load carrying capacity to cut becomes large (since a liquid crystal device is volume load) as it is shown in drawing 6 for example, It is related commonly [eye n watch], the charge and discharge from a liquid crystal load compare commonly from the 1st (n-1) to [watch], and a discharge charge is large. When the n-th most common actuation capacity is considered as a result, it is necessary to use an operational amplifier with the capacity of both charge discharge, and there is a problem that power consumption cannot be made small as much as possible.

[0007]

[Means for Solving the Problem] The resistance partial pressure circuit which has two or more resistance to which the power circuit for liquid crystal actuation of this invention pressures partially between the 1st power-source potential and the 2nd power-source potential, The 1st operational amplifier circuit which receives the output voltage of this resistance partial pressure circuit in an input, and carries out charge actuation of the liquid crystal display component, The 2nd operational amplifier circuit which receives the output voltage of said resistance partial pressure circuit in an input, and carries out discharge actuation of said liquid crystal display component, It is the configuration of having said 1st

operational amplifier circuit, the 1st switching circuit which switches said 2nd operational amplifier circuit to predetermined timing, and the timing circuit which controls this 1st switching circuit.

[0008] Moreover, it can also consider as the configuration which has the 2nd switching circuit which receives the output voltage of said resistance partial pressure circuit, and switches the supply level electrical potential difference of said resistance partial pressure circuit by said timing circuit.

[0009] Said the 1st switching circuit and said 2nd switching circuit of the power circuit for liquid crystal actuation of this invention can also consider as the configuration which synchronizes by said timing circuit and operates further again.

[0010]

[Embodiment of the Invention] The gestalt of operation of the 1st of this invention is explained with reference to drawing.

[0011] If drawing 1 is referred to, the power circuit for liquid crystal actuation of the gestalt of this operation will carry out impedance conversion of the resistance R which carries out potential division of between both the power sources of the plus side power source V0 and the minus side power source VEE, and the electrical potential difference divided, respectively, and will be equipped with the operational amplifier (OAa, OAb) which supplies 7 level of the power source for liquid crystal device actuation (V1, V2a, V2b, V3, V4 and Va, V5b). Furthermore, it has the timing generating circuit TM which controls the selector circuit SEL and selector circuit SEL which switch Amplifier (it is shown in A and B common n-th wave edge) OAa and OAb by change timing as shown in drawing 2 which took into consideration the sense of the charge and discharge to liquid crystal load carrying capacity about electrical-potential-difference V2b and V5b, and output electrical-potential-difference V2b and V5b, respectively. When each reference voltage (V1-V6) and the response by being common make an example duty several n liquid crystal equipment, eye common 1st- (n-1) watch will choose each level of an electrical potential difference V1, V2a, V5a, and V6, and the common n-th will choose electrical-potential-difference V1, V2b, V5b, and V6 level.

[0012] Next, if setting out of the resistance R on a circuit is explained, first, Resistance R only pressures partially between [V0-VEE] power sources fundamentally, and in order to make a current value small, it will choose the thing of a big constant. Moreover, resistance R' chooses a constant almost equal to the impedance of an operational amplifier (OAa or OAb), and equalizes the whole balance.

[0013] R " of resistance is the resistance which determines the current value passed in the low current circuit in each operational amplifier, and in order to make the whole consumed electric current small, it chooses the big thing about several 100Komega.

[0014] Moreover, by setting up in about dozens of microseconds in consideration of a segment and the response time of a common output about the pulse width ts and th shown in drawing 2 , time amount is enough taken so that there may be no effect on the display by gap of timing.

[0015] Next, the gestalt of operation of the 2nd of this invention is explained with reference to drawing 4 and drawing 5 .

[0016] If drawing 4 is referred to, except having further the selector circuit SEL2 which switches the output voltage of two pieces among the output voltage of resistance R' which adjusts the 1st power-source potential V0 to the level electrical potential difference V1, and a resistance partial pressure circuit, the gestalt of this operation is the same configuration as the gestalt of the 1st operation, gives the same reference mark to the same component, and is illustrated.

[0017] Timing circuit TM of the gestalt of this operation synchronizes and outputs the output 01 which drives a selector circuit SEL1 as shown in drawing 5 R> 5, and the output 02 which drives a selector circuit SEL2, and the liquid crystal display driver voltage (V1-V6) of the gestalt of this operation outputs the wave shown in drawing 5 by switch of selector circuits SEL1 and SEL2, respectively.

[0018] The gestalt of operation of the 2nd of this invention is circuitry in the case of adjusting an electrical potential difference V0, and when supplying from the

interior or the exterior by using plus side power-source potential V0 as the high voltage system power source VDD, it is not necessary to carry out impedance conversion of it using the operational amplifier circuit OAa. Therefore, the operational amplifier circuit OAa of an output level V1 becomes unnecessary. Moreover, OAa of the operational amplifier OAa which inputs output-level V2a, and the operational amplifier which inputs level V4 is that it is possible to use in common since it is not chosen simultaneously, and the operational amplifier OAb which inputs an output level V5, and the operational amplifier OAb which inputs an output level can also be shared within the same time amount. Therefore, it becomes possible to delete three pieces and to acquire the same effectiveness from the gestalt of the 1st operation of an operational amplifier circuit, and low-power-ization can be achieved further.

[0019]

[Effect of the Invention] As explained above, according to this invention, there is effectiveness which makes small power consumption of the semiconductor device for liquid crystal actuation which can prevent a wave-like distortion depended insufficient [the actuation capacity of a power source] and aggravation of image quality, and has a power circuit also in a display with a large capacity of liquid crystal material and the liquid crystal display component of a large-sized panel.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the circuit diagram of the gestalt of operation of the 1st of the power circuit for liquid crystal actuation of this invention.

[Drawing 2] It is the output timing wave of a timing circuit shown in drawing 1 .

[Drawing 3] It is the circuit diagram of the operational amplifier circuit shown in drawing 1 .

[Drawing 4] It is the circuit diagram of the gestalt of operation of the 2nd of this invention.

[Drawing 5] It is the output wave of a timing circuit shown in drawing 4 .

[Drawing 6] It is the circuit diagram of the conventional power circuit for liquid crystal actuation.

[Drawing 7] It is common and the timing chart which shows a segment wave at the time of the electrical potential differences V1-V6 of drawing 6 , and liquid crystal actuation.

[Description of Notations]

V1-V6 Liquid crystal driver voltage

V0 Plus power source

VEE Minus power source

OAa, b Operational amplifier

R Bleeder resistance

R' Auxiliary resistance

R" Bias resistance

TM Timing generating circuit

SEL Selector circuit

VDD High voltage system power source

[Translation done.]

* NOTICES *

JPO and NCIPI are not responsible for any
damages caused by the use of this translation.

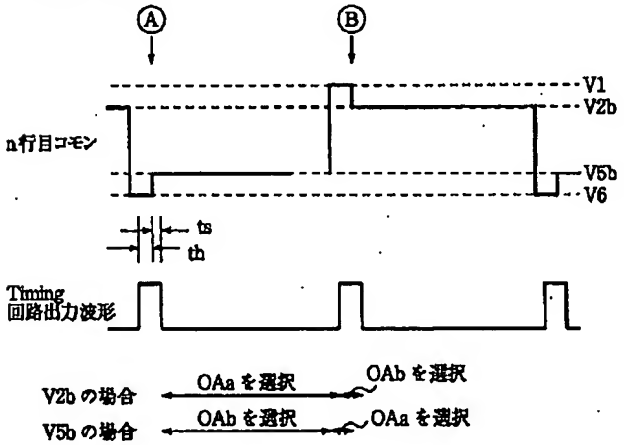
1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.**** shows the word which can not be translated.

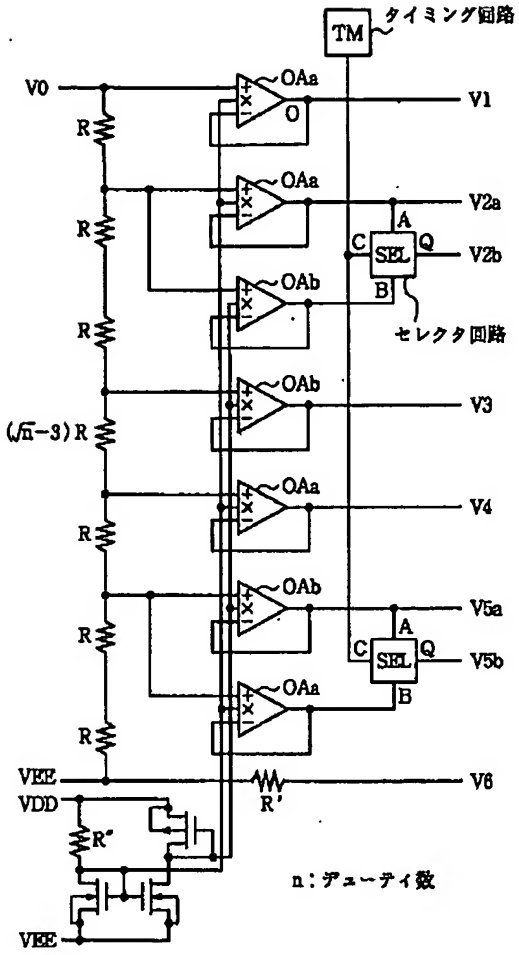
3.In the drawings, any words are not translated.

DRAWINGS

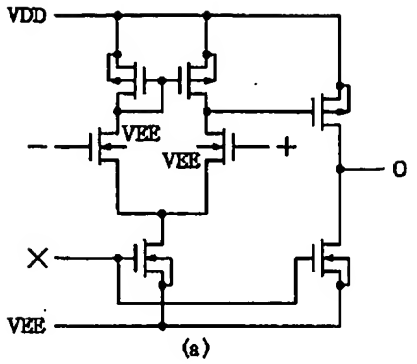
[Drawing 2]

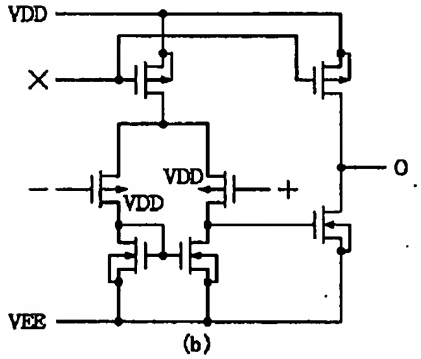


[Drawing 1]

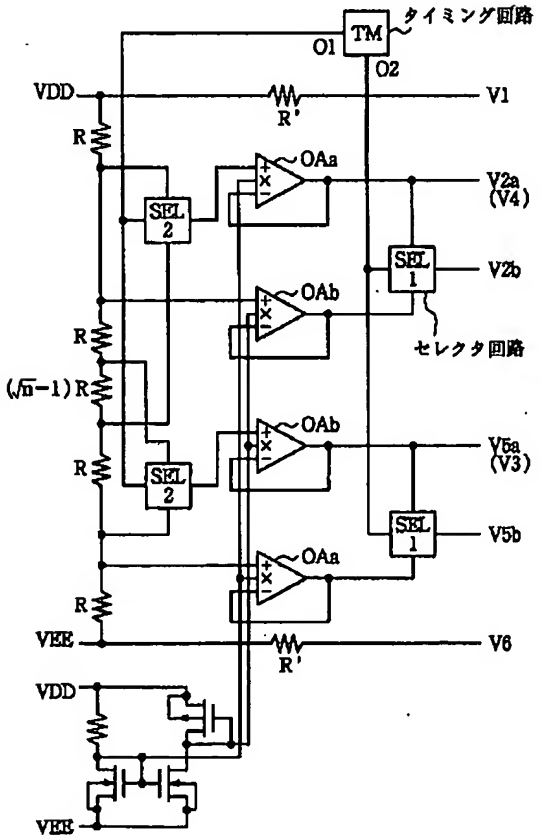

TM
タイミング回路
V0
OAa
V1
R
OAa
V2a
R
A
C
SEL
Q
V2b
OAb
B
R
セレクタ回路
OAb
V3
(√n−3)R
OAa
V4
R
OAb
V5a
R
A
C
SEL
Q
V5b
OAa
B
R
VEE
V6
R'
VDD
R"
n：デューティ数
VEE

[Drawing 3]

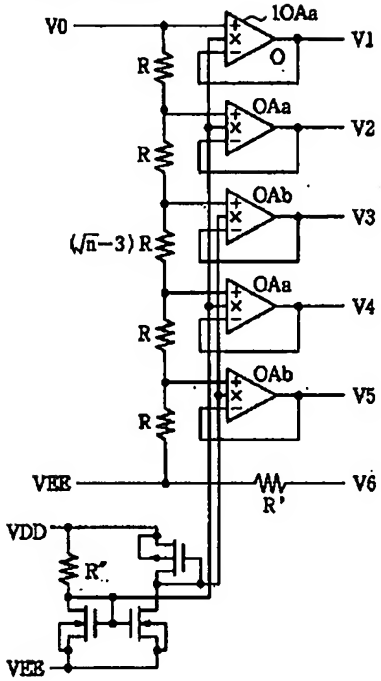

VDD
VEE
VEE
O
VEE
(a)


VDD
VDD
VDD
O
VEE
(b)

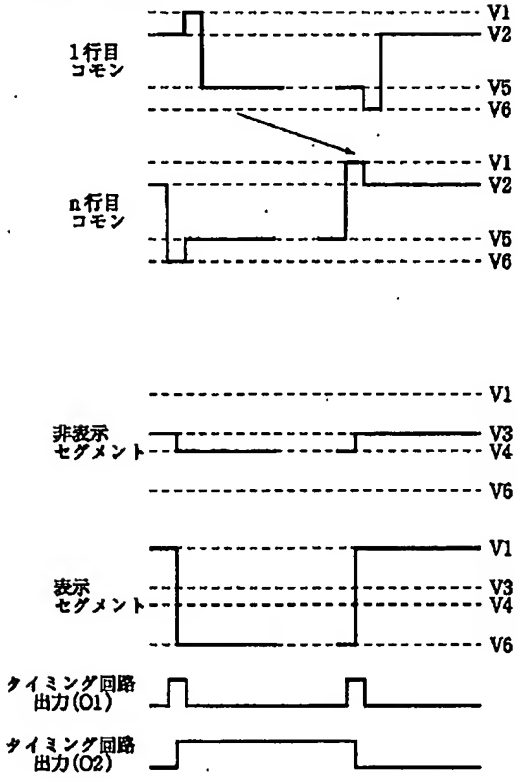
[Drawing 4]


TM
タイミング回路
O1
O2
VDD
R'
V1
R
OAa
V2a
(V4)
SEL
2
SEL
1
V2b
OAb
セレクタ回路
R
(√n−1)R
OAb
V5a
(V3)
R
SEL
2
SEL
1
V5b
OAa
R
VEE
R'
V6
VDD
VEE

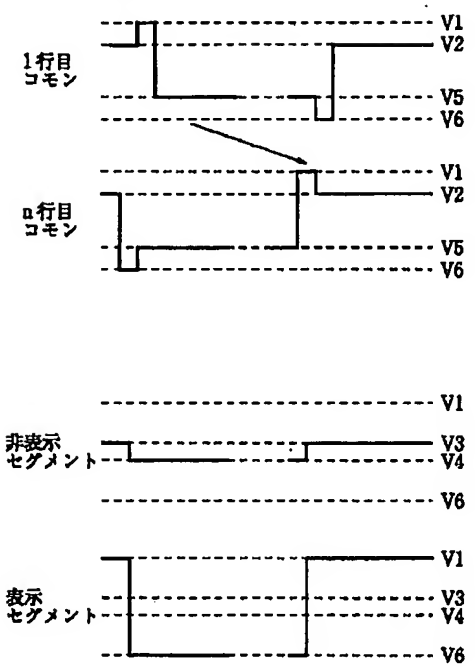
[Drawing 6]



[Drawing 5]



[Drawing 7]



[Translation done.]